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# DATA COMPRESSION OF SAR/MSS DATA SETS

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ABSTRACT IN LIEU OF MANUSCRIPT

## ABSTRACT

Earth observation satellites from NASA, France, the European Space Agency, Japan, and Canada will provide us with higher resolutions and more channels of remotely sensed data. If effective compression methods can be developed, there are potentially large cost savings to be obtained in transmitting, processing, storing, and disseminating these data. Resource management systems will likely make use of data from a variety of satellites having sensors operating in visible, infrared, and microwave regions. Research at CCRS in combining synthetic aperture radar (SAR) and multispectral scanner (MSS) imagery has demonstrated the complementarity of these data for agricultural interpretations (Goodenough et al, 1980).

In the summer of 1978 three-channel airborne synthetic aperture radar data and four-channel Landsat MSS imagery were acquired over an agricultural site near Grand Falls, New Brunswick. The SAR and MSS data were resampled and geometrically corrected to a ground resolution of 50 metres. The data sets from the two flights of the synthetic aperture radar, six channels, were combined with the four channels of the Landsat multispectral scanner to produce a ten channel, 50 metre resolution data set. We have investigated compressions of this data set through a clustering technique. The image is divided into windows and migrating means clustering performed on each window. Either these clusters or clusters of these clusters may be utilized to label pixel points. Data compression is achieved by reducing the number of bits required to characterize each pixel.

The effectiveness of this compression may be measured by the mean square error between the original image and the reconstructed image and by classification accuracy obtainable on the reconstructed image compared with that obtainable on the original image.

The following results have been obtained. The square window gives a smaller mean square error than various rectangular windows for the same area and same number of clusters. The mean square error decreases when more clusters are used for each window. The mean square error is approximately linearly related to the compression ratio. The classification accuracy achieved for the reconstructed image matches that of the original image for small numbers of clusters. However, the mean square error decreases as the number of clusters is increased. The reason for this is that the clustering within windows is a smoothing operation of the image. The result is that the class variance is decreased in the reconstructed image.

From the point of image quality and retention of image detail, the following results were obtained. The compression tends to smooth the intensity variation across the agricultural fields. However, narrow boundaries and fields are sometimes lost through the compression. This can be avoided by using larger numbers of clusters. When an insufficient number of clusters is used, artificial boundaries appear between the various windows. We conclude from our study that the clustering compression method reduces the noise in the image, preserves or increases classification accuracy through image smoothing, and achieves a high compression ratio. Compression ratios of a factor of ten with classification accuracies improved by at least 5%, have been obtained for the ten channel data sets. The upper bounds for compression appears to be limited by the need to preserve spatial resolution, such as narrow agricultural fields, and the necessity to eliminate artificial boundaries caused by the use of limited numbers of clusters. The details of these experiments are reported in the paper.